Work, health and welfare: The association between working conditions, welfare states and self-reported general health in Europe.

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Abstract

This paper is the first to examine the association between self-reported general health and a wide range of working conditions at the European level and by welfare state regime type. Data for 21,705 men and women aged 16-60 years from 27 European countries were obtained from the 2010 European Working Conditions Survey. The influence of individual level socio-demographic, physical and psychosocial working conditions, and the organisation of work, were assessed in multilevel logistic regression analyses with additional stratification by welfare state regime type (Anglo-Saxon, Bismarckian, Eastern European, Scandinavian and Southern). At the European level, we found that 'not good' general health was more likely to be reported by workers more exposed to hazardous working conditions. Most notably, tiring working positions (1.78, 1.64 – 1.94), job strain (1.42, 1.32 – 1.54) and temporary job contracts (1.24, 1.13 – 1.37) were strongly associated with a higher likelihood of reporting 'not good' health. Analysis by welfare state regime found that only tiring or painful working conditions were consistently associated with worse self-reported health in all regimes. There was no evidence that the Scandinavian welfare regime protected against the adverse health-effects of poor working conditions. The paper concludes by examining the implications for comparative occupational health research.

200 words

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Introduction

It is well established that work is an important social determinant of health and health inequalities [1-2]. Hazardous physical working conditions (e.g. ergonomic problems), stressful psychosocial work environments (e.g. high job demands and low job control), and some elements of the organisation of working life (e.g. long working hours, poor job security and shift work) have all been associated with adverse health outcomes including psychological ill health, coronary heart disease and musculoskeletal problems [2]. Previous European research in this field has been largely based on single country studies, and has often focused on only one particular aspect of working conditions (most notably the psychosocial work environment or job insecurity). In this paper, we are the first to examine the association between working conditions and health at the European level and to do so using a wide range of working conditions covering key elements of the physical and psychosocial work environment as well as the organisation of work. Additionally, as previous comparative studies of health in Europe have found variation by welfare state regime [e.g. 3-6] and because there are potentially important cross-national variations in workplace regulation, the labour market context and social protection systems [7], this paper is also the first to compare a wide range of working conditions, and their association with health, by welfare state regime.

Working Conditions and Health

Hazardous Physical Working Conditions and Health

Recent research into the physical work environment has particularly focused on ergonomic hazards including vibration exposure, lifting heavy loads, work which involves painful positions, and repetitive work. Epidemiological evidence has accumulated demonstrating an association between exposure to vibration (e.g. by the regular and frequent use of vibrating hand-held tools, driving heavy vehicles or operating certain machines) and musculoskeletal disease as well as hand arm vibration syndrome and carpal tunnel syndrome [8]. For example, a systematic review found that lower back pain was more frequent in workers exposed to whole body vibration [9]. Work involving tasks such as lifting and carrying heavy loads or people is also known to be a risk factor for the development of musculoskeletal disorders particularly of the lower back [10]. Similarly, work involving repetitive movements has been associated with an increased prevalence of musculoskeletal symptoms involving the neck, shoulders, and upper extremities [11]. There is also tentative evidence to suggest that mental health conditions tend to be more frequently reported by workers exposed to repetitive work [12]. Working in strenuous, painful and static postures is also associated with musculoskeletal symptoms [13-14].

Psychosocial Work Environment and Health

The 'psychosocial work environment' is a collective way of referring to psychological and social influences on health such as time pressure, social reciprocity, job control and autonomy, fairness, and work demands. In public health research, the most popular contemporary conceptual framework of the relationship between the psychosocial work environment and health is the job strain (or demand-control-support) model [15]. This

asserts that jobs with high psychological demands (e.g. time pressure, high work pace, high work load and conflicting demands) coupled with low levels of control (control over workload, the variety of work, skill development and utilization) are 'high strain' jobs which can lead to an increased risk of stress-related morbidity and mortality [2]. There is strong evidence of relationships between job strain and adverse health outcomes including coronary heart disease [16] and associated risk factors [17-18], musculoskeletal pain as well as psychological ill health [20]. For example, a systematic review found that the relative risk of coronary heart disease ranged from 1.5 to 4.95 for adverse psychosocial work characteristics [16]. Dose-response relationships have been identified in cohort studies between job strain and obesity [17], the metabolic syndrome [18] and psychiatric disorders [20]. Apart from job strain, other concepts of psychosocial stressors at work like the effort-reward-imbalance model have been widely tested and yielded comparable results [21].

Organization of Work and Health

The nature of work in Europe has altered considerably in recent decades, with a rise in flexible – or precarious - employment: increasing numbers of people are working on either temporary contracts or no contracts, characterized by lower levels of security and poorer working conditions [22]. Precarious employment is usually associated with low income, long and unsociable working hours and high job strain [23]. A number of adverse physical and mental health indicators are associated with precarious employment including stress, fatigue, backache and muscular pains, self-reported health, minor psychiatric morbidity, blood pressure, health related behaviours as well as mortality (24-26]. There is also a sizeable body of evidence that demonstrates the negative effects of shift work, and particularly night work, on health and wellbeing [27-28]. Reported health problems include

sleep disturbances, fatigue, digestive problems, emotional problems, cardiovascular problems, and stress-related illnesses, as well as increases both in general morbidity and in sickness absence [29-30]. Long working hours have also been shown to have negative health impacts [31] and shift work, and working long hours or abnormal hours may result in work-life balance problems which can in turn result in poorer health [32].

Work, Health and Welfare

Welfare State Regimes and Health

It is now widely acknowledged that welfare states are important macro-level determinants of health [19]. Even in its most narrow definition - as the state's role in education, health, housing, poor relief, social insurance and other social services - the welfare state clearly plays a mediatory role in the influence of the material and social determinants of health. This is most obvious in terms of the strong relationship between universal health care systems, higher levels of health care decommodification, better population health and lower health inequalities (for an overview see Beckfield and Kreiger, 2009) [34]. However, as has been argued elsewhere [2], the welfare state cannot merely be reduced to a set of specific social benefits and welfare services: it is a complex system of stratification and regulation which sets the broader parameters in which all the other social determinants of health (including the work environment) take place.

Social epidemiology has increasingly used welfare state variation to frame analyses of cross-national differences in population health. Welfare state provision varies extensively across Europe, but typologies have been put forward to categorise them into distinctive types - welfare state regimes [19]. Welfare state regimes place those welfare states that are the

most similar (in terms of political tradition, principles, levels of provision, etc) together, emphasising within regime coherence and between regime differences [33]. Ferrera's (1996) [35] four-fold typology, which focuses on different dimensions of how social benefits are granted and organised, has been highlighted as one of the most empirically accurate welfare state regime typologies [33]. Ferrera makes a distinction between the Scandinavian, Anglo-Saxon, Bismarckian and Southern countries (see Box 1). More recently, the Eastern European countries have been added as distinct regime type [36-37].

These comparative studies of welfare states and health have often concluded that Infant Mortality Rates (IMR) are improved by the relatively generous and universal welfare provision of the Scandinavian countries, especially when contrasted to the Anglo-Saxon welfare states [3-6, 38]. IMR are lowest in the Social Democratic Scandinavian countries and highest in the Liberal Anglo-Saxon and Southern regimes. For example, Chung and Muntaneer (2007) [38] found that around 20% of the difference in IMR between countries could be explained by the type of welfare state with Scandinavian countries having significantly lower rates, compared to all other welfare state regimes. However, research findings are less consistent in terms of the benefits of the Scandinavian welfare state regime in terms of other outcomes such as life expectancy or self-rated health. For example, in their review of studies of the association between welfare states and health, Muntaneer et al (2011) [39] found that only 61% of studies found a positive advantage to Scandinavia.

Working Conditions, Welfare States and Health

Siegrist and Theorell (2006) [40] argue that it is critical to take account of wider society-level economic, political and social context when thinking about how working conditions impact

on health. In this way, welfare state regimes - with their varying levels of social protection and workplace health and safety regulation - may be important influences on the work environment and also on the impact of adverse working conditions on health [2]. Although regulation of working conditions in the countries of the European Union (EU) are under the general guidance of the EU (e.g. the 1989 EU Council Direction 89/391/EEC set out the general principles guiding further EU and member state policies), there is still considerable variation. For example, only Norway and Sweden having explicit legislation relating to the psychosocial work environment with (e.g. the 1991 Swedish Work Environment Act) and, as another example, the UK operates an opt-out clause for workers in regards to the EU Working Time Directive (more commonly referred to as the 48 hour working week).

Reflecting this, epidemiological work has started to compare whether working conditions and their relationships with health vary by welfare state regime. To date this research has focused on the psychosocial work environment finding a lower prevalence of job strain and work-related stress in countries with more comprehensive welfare states (and where the work environment is more regulated such as Sweden or Norway), and reduced impacts on health in these countries [7,41]. For example, Dragano and colleagues (2011) [7] found that job strain was highest in the Southern welfare states and that welfare state regime type accounted for almost 75% of the differences between countries. In terms of the association between job strain and health, there were significant variations by welfare state regime type: highest in the Anglo-Saxon welfare state regime and lowest in the Scandinavian one. This suggested that the health impacts of stressful work environments are less pronounced in welfare states with higher levels of social protection. Similarly a comparative study of Britain, Finland and Japan by Sekine and colleagues (2009) [41] concluded that the smaller

inequalities in work characteristics and mental ill health in the Finnish cohort *"may be attributable to the universal and egalitarian policies of Social Democratic countries because ... policies such as extensive welfare and social services, full employment policies, wealth redistribution through tax and transfer systems are considered to result in less inequalities in working conditions and health".* Further, the relationship between job insecurity and poor health is less in those countries with more extensive social security systems which improve the ability of individuals to cope with stressful events [42]. Comparative studies of the effects of unemployment on health have also identified important differences in the magnitude of the relationship by welfare state regime with relative inequalities largest in the Anglo-Saxon countries [37].

Theoretical Framework

Existing studies therefore suggest that the effect of working conditions on health may be modified by welfare arrangements. Dragano et al. (2011) [7] and Sekine et al. (2009) [41] outline a general resource model which assumes that generous social protection schemes help individuals cope with stressful life events and conditions. We extend on this perspective and propose that the welfare state has the potential to buffer against the health consequences of both physical and psychosocial work strains. This 'modifying effect' of the welfare state may operate through two basic mechanisms: control and resilience. Within a 'welfare resources' perspective it is hypothesised that universal and generous welfare states provide individuals the opportunity to have "*command over resources in terms of money, possessions, knowledge, psychological and physical energy, social relations, security and so*

on by means of which the individual can control and consciously direct her conditions in life" [44]. This perspective emphasises control ('command over resources') and the way that resources enable individual decisions and action in a way that resembles Sen's capability approach [45]. Individual and collective resources that strengthen individual capability may in turn enhance individual resilience; *"the process of avoiding adverse outcomes or doing better than expected when confronted with major assaults on the developmental process"* [46]. A comprehensive welfare state may therefore modify the adverse effects of working conditions on health by increasing capabilities and resilience in the working population and making them less vulnerable to health hazards at work - in the following ways:

Firstly, universal access to generous sickness absence compensation during self-certified shorter sickness spells may enhance labour force participation among chronically ill and individuals with marginal health resources. Having the opportunity to take a few days off work without significant loss of income might prevent temporary work-related health problems to grow into permanent sickness. In the opposite case of no benefits or fairly low replacement ratios for short-term sickness absence, many workers may exhaust their health potential in order to avoid the short-term economic penalty of absence ('presenteeism'). This behaviour has the potential of amplifying health problems. Also, many chronic conditions fluctuate in intensity. Hence, universal and generous sickness absence schemes may install a kind of flexibility in working life which makes the health-work environment interaction less pronounced.

Secondly, generous out-of-work-benefits and active labour market policies (ALMPs) may enhance a better match between individual health resources and job demands/working

conditions. For instance, Tatsiramos (2009) [47] shows that the duration of the first job after a spell of unemployment is longer among individuals living in countries with more generous unemployment benefits than those living in countries with lower replacement ratios. More generous out-of work-benefits provide time to find an appropriate job, rather than having to jump into the first available offer because of economic necessity. At the same time, generous benefits and spending on ALMPs are highly correlated [48]. Up-skilling and re-skilling of the benefit population may also enhance job match. If more people have a job that fits their manifest and latent health potential one might assume that the observed health effect of a given working condition would be smaller than if people were given less choice or less opportunities of learning more appropriate skills.

Thirdly, countries with generous welfare benefits – the Scandinavian countries - also have higher minimum wages and narrower wage distributions. Minimum wages have to be significantly higher than social benefits in order to install work incentives. This improves workers' bargaining position and exerts a pressure from below on the wage distribution [49]. This way, generous welfare states redistribute material resources not only through out-of-work-benefits, but also through its effect on wage formation. A given low-status job with a given exposure profile would be relatively better paid in a redistributive society than in other countries. As income has been found to have an independent effect on self-rated health (e.g. Geyer et al. 2006) [50], higher minimum wages may increase resilience to occupational exposures particularly in lower status occupations, for example by securing low-end employees better material living conditions (such as a car or a decent dwelling) and better opportunities to buy services (vacations, health services, practical help, etc.) and by installing a better effort-reward balance by making the reward comparably higher. Health

and resilience may also be improved by a relatively smaller perceived income inequality and a sense of a better social standing [51].

Fourthly, a hallmark of Scandinavian Social Democratic welfare states are their taxation-financed service provision. These services, particularly in the form of care to elderly and children may reduce physical and mental strain experienced by individuals who have care responsibilities. For instance, a full –time subsidised child care service compared to an expensive private or short-hours child care, may reduce stress in parents, and hence make them less prone to the adverse consequences of poor working conditions. A recent multi-level study by Esser and Ferrarini (2010) [52] suggested that perceived stress and work-family-conflict was lower in countries pursuing dual-earner family policies. A parallel argument may be made in the case of elderly care or care for impaired children.

Finally, generous social protection is also accompanied by greater bargaining power for labour unions which they use not just to enhance wages but also to improve the regulation of working conditions. So, the Scandinavian countries have stronger and more comprehensive workplace regulations than other European countries (especially in terms of the psychosocial work environment in Norway and Sweden). It is expected that the health of workers' exposed to potentially damaging working conditions in these countries will benefit from these additional regulations so that, for example, workers exposed to noise may be required to wear additional protection, whilst those exposed to repetitive work may be entitled to additional or longer rest breaks, than in other countries. Enhanced enforcement of such regulations with more regular inspections may also reduce the relationship between hazardous working conditions and ill health. Similarly, the state will try to limit expenses to

the social security system by forcing employers - and incentivising them to - reduce work-related health damage: the gap between tax *income* per average worker and the average *expenses* per disabled worker is much greater in generous welfare states because of high minimum wages and generous benefits. Hence, the state has a very strong incentive for keeping people in the work force.

Research Questions

This paper therefore examines two research questions:

(1) What is the association between working conditions and health in Europe?
(2) Do the associations between working conditions and health vary by welfare state regime?

Based on the previous research reviewed above and our theoretical framework, we would expect to find a negative relationship between hazardous working conditions and health in Europe although we would expect variation by welfare state type with a weaker association between working conditions and health in the Social Democratic Scandinavian countries.

Methods

Data and Variables

Data were obtained from the 2010 European Working Conditions Survey (EWCS). This periodical survey is conducted every 5 years by the European Foundation for the Improvement of Living and Working Conditions, an autonomous European Union agency. The survey included more than 100 questions on a wide range of issues regarding

employment and working conditions. It is a unique source of comparative information and this is the first academic study to utilise the data in relation to the association between work and health. The survey has been carried out five times from 1990 to 2010. For the analyses we used the most recent – fifth - survey from 2010. We analysed data from 27 countries. The survey sample is representative for all residents of the included countries aged 15 or older and who are in employment. In each country, a multistage, stratified random sampling method was used. The survey interviews were carried out face-to-face at respondents' homes. The overall response rate was 44% for the fifth EWCS with considerable variation by country (ranging from 31% in Spain to 74% in Latvia). Further details on the survey design and sampling frame are available elsewhere [53-54].

Details of the sample are provided in Table 1. The sample for this analysis is restricted to men and women aged 16 to 60 years to include only persons below the typical European retirement age of 60 years. Although in some countries the mean retirement age is higher than 60 years, a considerable part of the workforce retires around 60. To avoid selection processes in relation to retirement (e.g. healthy worker effect). We restricted our analyses to those aged under 60. We also excluded persons working less than 15 hours a week, working in the armed forces and the self-employed. After excluding persons with missing data on the exposure, outcome and covariates a total of 21,705 participants were available for the final analysis.

Health was measured in terms of self-reported general health. Self-reported general health was constructed from a variable asking "*How is your health in general? Would you say it is …*

very good, good, fair, bad, very bad". The variable was dichotomized into 'very good or good' health versus 'not good' health. Sex and age (four categories 16-29, 30-39, 40-49, 50-60) were included as individual level demographic variables. We also included variables to measure occupation coded using the International Standard Classification of Occupations (ISCO), the standard industrial classification (NACE) and education. Education was measured according to ISCED-97 (four categories: no education/primary, secondary, post secondary, tertiary). To assess physical and psychosocial working conditions several indicators were used in the analyses. Five indicators were used to assess physical working conditions: (1) vibrations from hand tools, machinery, etc.; (2) tiring or painful positions; (3) lifting or moving people; (4) carrying or moving heavy loads; and (5) repetitive hand or arm movements. If the respondent stated that she/he is working more than 50% of the time under these conditions she/he is classified as having poor physical working conditions. To measure psychosocial working conditions, we used the well-established demand-control model [15]. Job strain was defined by the combination of high demands (2 items) and low control (7 items). The demand and control scales were dichotomized at the median to define high and low levels of demand and control. Respondents with high demand scores and low control scores were defined as having job strain. We also included several variables to measure the organisation of work: public/private/third sectors, temporary or indefinite contract, shift work (yes/no), working at night (how many times a month), working at weekends (how many times a month) and average working hours per week. Sample characteristics are shown in Table 1.

The classification of European countries into welfare state regimes follows that proposed by Bambra and Eikemo (2009) [37] based on Ferrera (1996) [35]. This typology divides European countries into five types of welfare state regime: Scandinavian, Anglo-Saxon, Bismarckian, Southern Europe and Eastern Europe (see Box 1).

Statistical Analysis

After basic sample description, calculations of country specific prevalence of 'not good' self-reported health and calculations of the prevalence of working conditions by welfare state regime, logistic regression models of associations were calculated adjusting for age, sex and gross domestic product. Given the multilevel structure of the data, we applied multilevel fixed effects logistic regression methods with individuals (level 1) nested within countries (level 2) [55]. This accounts for between country variation. To assess the association between working conditions and health in Europe we first included individual-level socio-demographic variables (model 1). Next we separately added the physical work environment (model 2), the psychosocial work environment (model 3) and the organization of work variables (model 4). In the final model, all of the working condition variables were combined (model 5). The final model 5 analysis was repeated separately for each of the five welfare state regimes. Sensitivity analysis was carried out that adjusted for response rates. We also checked against over-adjustment by redoing the analysis with only age and sex as the confounders. All calculations were done using STATA 11.

Results

Working Conditions and Health in Europe

The results of the multilevel fixed effects logistic regression models of the association between working conditions and 'not good' health in Europe are presented as odds ratios and 95% confidence intervals in Table 2. This shows that in Europe, the working age population exposed to adverse working conditions are more likely to report 'not good' health than those who experience better working environments. Model 1 (socio-demographic characteristics) shows that self-reported 'not good' health is more likely amongst women (OR=1.22, 95% CI 1.18 to 1.38) than men (1.0), older workers (e.g. age 50-60 OR=4.43, 95% CI 3.94 to 4.97) than younger workers (1.0), primary educated (1.0) than higher educated (OR=0.52, 95% CI 0.42 to 0.63), and lower occupations (e.g. elementary occupations OR=2.3, 95% CI 1.90 to 2.78) compared to higher occupations (e.g. legislator OR=1.0). There were no significant differences in self-reported health by employment sector (Nace).

In terms of working conditions, analysis controlling for the socio-demographic covariates found a clear influence of the physical work environment on self-reported health (Table 2, model 2): those workers exposed to vibrations (OR=1.1, 95% CI 1.01 to 1.23), tiring or painful positions (OR=1.87, 95% CI 1.72 to 2.02), heavy loads (OR=1.24, 95% CI 1.13 to 1.36), and repetitive movement (OR=1.28, 95% CI 1.18 to 1.38) were all more likely to report 'not good' health. There was no significant association with health for lifting people.

The psychosocial work environment analysis (Table 2, model 3) found that workers exposed to high levels of job strain were significantly more likely to report 'not good ' health than those with low levels (OR=1.72, 95% CI 1.60 to 1.85).

The association between health and the organisation of work was more varied (Table 2, model 4). There were significant associations for employment contract (temporary contract workers more likely than indefinite contract workers to report 'not good' health, OR=1.26, 95% CI 1.14 to 1.39), employment sector (with worse health reported by those in the third sector, OR=1.20, 95% CI 1.04 to 1.37), shift work (OR=1.11, 95% CI 1.01 to 1.21) and frequency of weekend working (OR=1.03, 95% CI 1.01 to 1.05). However, there was no association between health and number of working hours or frequency of night work.

These associations with 'not good' self-rated health all remained significant (except for vibrations and shift work) in the combined analysis, albeit with reduced effect sizes (e.g. the heavy loads OR reduced from 1.24 to 1.19) (Table 2, model 5). In particular, tiring or painful working positions (OR=1.78, 95% CI 1.64 – 1.94), job strain (OR=1.42, 95% CI 1.32 – 1.54) and temporary job contracts (OR=1.24, 95% CI 1.13 – 1.37) were still strongly associated with a higher likelihood of reporting 'not good' health.

Sensitivity analysis found that adjusting for response rates and confounders did not change the results.

<u>Welfare State Regimes, Working Conditions and Health</u>

These combined analysis associations at the European level differed considerably when the analysis was stratified by welfare state regime (Table 3). For example, only working in tiring

and painful positions had a consistently negative association with 'not good' health in all five of the welfare state regime types and job strain was significantly negatively associated with 'not good' health in all except for the Anglo-Saxon (OR=1.26, 95% CI 0.87 to 1.83). In contrast, significant associations with health for vibrations were only found in Southern Europe (OR=1.55, 95% CI 1.14 to 2.10), lifting or moving people (OR=1.35, 95% CI 1.02 to 1.79) and shift work (OR=1.27, 95% CI 1.10 to 1.46) only in the Eastern regime, third sector employment only in the Bismarckian regime (OR=1.32, 95% CI 1.07 to 1.62) , heavy loads only in the Bismarckian (OR=1.32, 95% CI 1.13 to 1.55) and Southern (OR=1.50, 95% CI 1.10 to 2.03) regimes, temporary contracts in the Bismarckian (OR=1.36, 95% CI 1.15 to 1.61) and Eastern (OR=1.29, 95% CI 1.10 to 1.51) regimes, and weekend work only in the Scandinavian (OR=1.07, 95% CI 1.01 to 1.13) and Bismarckian (OR=1.05, 95% CI 1.02 to 1.08) welfare states. Repetitive movements had no association with health in the Anglo-Saxon (OR=1.18, 95% CI 0.81 to 1.72) or Southern (OR=1.24, 95% CI 0.96 to 1.60) regimes. Most notably, the association between health and working conditions was less pronounced in the Anglo-Saxon regime where only tiring or painful positions had a significant association with 'not good' health (OR=2.04, 95% CI 1.33 to 3.13).

In terms of comparing the association between working conditions and health by welfare state regime, there were some notable differences in the size of associations by welfare state (Table 3). For example, in terms of tiring or painful positions, whilst the association was significant in all welfare state regimes, the size of association was largest in the Scandinavian and Bismarckian regimes and smallest in the Southern one. Similarly, job strain had a stronger association with 'not good' health in the Bismarckian and Southern regimes than the others. However, there was no clear or consistent pattern to these results and only

the differences in the association with working hours reaches statistical significance (p<.00) when the welfare state regimes are compared but the differences in association size are very small.

Sensitivity analysis found that adjusting for response rates and confounders did not change the results.

Discussion

In summary, we found that in Europe 'not good' general health was more likely to be reported by workers more exposed to hazardous working conditions. Most notably, tiring working positions (1.78, 1.64 – 1.94), job strain (1.42, 1.32 – 1.54) and temporary job contracts (1.24, 1.13 – 1.37) were strongly associated with a higher likelihood of reporting 'not good' health. However, there were few significant differences by welfare state regime, although the association between health and working conditions was less pronounced in the Anglo-Saxon regime. These results therefore only partially confirm our expectations.

Our finding that hazardous working conditions are associated with worse health at the European level is in keeping with expectations from single country studies that have shown strong adverse associations with physical, psychosocial and work organization characteristics [2]. The finding that tiring or painful working positions, job strain and temporary job contracts were the most strongly associated with worse self-rated health in Europe is also in keeping with previous research. For example, a study by Fredriksson et al (2001) [13] found that working in strenuous, painful and static postures is associated with musculoskeletal symptoms and there is also evidence to suggest that mental health

conditions such as anxiety, depression and psychological tension tend to be more frequently reported by workers exposed to tiring work [12]. In terms of job strain, Dragano et al (2011) [7] found a consistently negative association between job strain and stress across Europe. There is also a well-established literature on the adverse effects on health of insecure and temporary work, most notably in terms of 'precarious' employment (which includes informal work, temporary or fixed-term work, contract work, casual work, piece work, home-working, part-time work) – basically a lack of labour market regulation [56]. Precarious work is associated with fatigue, injuries, musculoskeletal disorders as well as psychological and physical wellbeing [23], self-reported health, minor psychiatric morbidity, physiological measures (blood pressure) and health-related behaviours [25], and mortality [26]. Work with little security can be as health damaging as unemployment [56].

From a policy perspective, that these working conditions exist across Europe and adversely affect health should be a great concern. Precarious employment represents around 15% of all forms of paid employment across the European Union [24]. Women and immigrants tend to be over-represented in temporary forms of work [57]. Precarious employment is usually associated with low income, long and unsociable working hours and often high strain and stress [23]. Despite great progress towards a European Social Model in the post-war period in which working conditions were more highly regulated, since the 1980s, job strain and temporary contracts have increased and 'precarious' employment is becoming more commonplace [58]. This is as a result of a sustained period of neoliberalism in Europe (and beyond) in which European labour markets were 'deregulated' and workers, job seekers and unions disempowered. This trend continues today, and is in fact being exacerbated by the austerity measures enacted since the 'Great Recession' started in 2008 [59].

The results of previous cross-national research into differences by welfare states in the association between job strain and health [7, 41], and in unemployment and health [37], alongside the expectations from our theoretical framework, meant that we expected to find meaningful differences in the association between working conditions and health by welfare state regime, and specifically that the association would be weaker in the Scandinavian countries. However, our empirical analysis does not support this hypothesis – there were few differences by welfare state regime in the association between working conditions and health, and if anything, the association was weaker in the Anglo-Saxon countries (where for example, job strain was not significantly associated with health) not the Scandinavian ones.

This unexpected finding suggests that the welfare state regime approach may not be the best way of analyzing the association between working conditions and health. There are other approaches that could be taken to examine the impact of macro-level policy variables on the social determinants of health. For example, legislation, GDP, demand for labour, tertiarisation/de-industrialisation, social expenditure or institutional measures could all be alternatives to the welfare regime approach. Indeed, work by Rosskam (2009) [60] on the international regulation of working conditions has shown that work place regulation does not divide neatly across welfare state regime lines. Rosskam's international typology of health and safety regulation found that countries clustered into four types: 'Pacesetters', 'Pragmatists', 'Conventionals' and 'Much to be done'. European countries were categorised as Pacesetters (Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland), Pragmatists (Austria, Czech Republic, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Poland, Slovakia, UK) or

Conventionals (Bulgaria, Croatia, Ukraine) [60]. Pacesetter countries performed well in terms of legislative frameworks, implementation and health and safety outcomes. Pragmatists did well in terms of health and safety outcomes despite a poor legislative framework and slack implementation. Countries in the Conventional group performed well in terms of legislation, but poorly in terms of implementation and outcomes, suggesting that laws to protect workers' health were not translated into practice. This also suggests that the Anglo-Saxon countries of the UK and Ireland do well in terms of work-related health outcomes despite their less developed regulation of working conditions. This suggests that there are other factors that need to be considered when examining cross-national differences in the association between work and health and that the welfare state regimes approach is unable to offer as much insight as expected.

Our findings may of course be a matter of artifact – a byproduct of the limitations of the data, variables and methods used to analyze working conditions and welfare states. The EWCS dataset is subject to a number of limitations most notably in terms of its response rate of 44% (ranging from 31% in Spain to 74% in Latvia) and the prevalence of ill health also varied considerably from 8% in Ireland to 56% in Latvia. However, we did conduct sensitivity analyses (available from authors on request) adjusting for response rate differences and our results were unchanged. The health measures in this study are self-rated and it is only cross-sectional and so it is not possible to establish any causal relationship between poor working conditions and health. However, the EWCS also has a number of strengths most notably that it is the only survey of its type conducted across Europe. By using data from the EWCS we are able to conduct analyses for work-life balance and health in 27 European countries. The data set has also been used by other epidemiologists to examine psychosocial working

conditions [61]. We also applied multi-level models to take account of the hierarchical structure of the data and the sample was large enough to conduct multivariate statistical analyses with appropriate confounder control.

Conclusion

This paper is the first to examine the association between self-reported general health and a wide range of working conditions at the European level and by welfare state regime type. We have found that 'not good' general health was more likely to be reported by workers more exposed to hazardous working conditions. Most notably, tiring working positions (1.78, 1.64 – 1.94), job strain (1.42, 1.32 – 1.54) and temporary job contracts (1.24, 1.13 – 1.37) were strongly associated with a higher likelihood of reporting 'not good' health. Analysis by welfare state regime found that only tiring or painful working conditions were consistently associated with worse self-reported health in all regimes. There was no evidence that the Scandinavian welfare regime protected against the adverse health-effects of poor working conditions.

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Box 1: European welfare state regimes (ranked by levels of social protection 1-5, high–low)

1. Scandinavian (Denmark, Finland, Norway, Sweden)

Characterised by universalism, comparatively generous social transfers, a commitment to full employment and income protection; and a strongly interventionist state. The state is used to promote social equality through a redistributive social security system. Unlike the other welfare state regimes, the Scandinavian regime type promotes an equality of the highest standards, not an equality of minimal needs and it provides highly decommodifying programs.

2. Bismarckian (Austria, Belgium, Germany, France, Luxembourg, Netherlands)

Distinguished by its 'status differentiating' welfare programs in which benefits are often earnings related, administered through the employer; and geared towards maintaining existing social patterns. The role of the family is also emphasised and the redistributive impact is minimal. However, the role of the market is marginalised.

3. Anglo-Saxon (Ireland, UK)

State provision of welfare is minimal, social protection levels are modest and often attract strict entitlement criteria; and recipients are usually means-tested and stigmatised. In this model, the dominance of the market is encouraged both passively, by guaranteeing only a minimum, and actively, by subsidising private welfare schemes. The Anglo-Saxon welfare state regime thereby minimises the decommodification effects of the welfare state and a stark division exists between those, largely the poor, who rely on state aid and those who are able to afford private provision.

4. Southern (Greece, Italy, Portugal, Spain)

The southern welfare states have been described as 'rudimentary' because they are characterised by their fragmented system of welfare provision which consists of diverse income maintenance schemes that range from the meagre to the generous and welfare services, particularly, the health care system, that provide only limited and partial coverage. Reliance on the family and voluntary sector is also a prominent feature.

5. Eastern (Bulgaria, Croatia, Czech Republic, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia)

The formerly Communist countries of East Europe have experienced the demise of the universalism of the Communist welfare state and a shift towards policies associated more with the Anglo-Saxon welfare state regime notably marketisation and decentralisation. In comparison with the other member states of the European Union, they have limited welfare services.

Adapted from Bambra 2007; Eikemo and Bambra 2008.

Table 1: Sample socio-demographic, work environment and work organization characteristics (N= 21,705 in 27 European countries)

Characteristic	Details	N (%) or mean (SD)
Sex	Male	10352 (47.7%)
	Female	11353 (52.3%)
Age	16-29	4028 (18.6%)
	30-39	5910 (27.2%)
	40-49	6318 (29.1%)
	50-60	5449 (25.1%)
Education	No/primary education	758 (0.4%)
	Secondary	12791 (58.9%)
	Post secondary	1203 (5.5%)
	Tertiary	6953 (32.03)
NACE	Agriculture, hunting, forestry and fishing	444 (2.1%)
	Industry	5495 (25.3%)
	Services	8057 (37.1%)
	Public administration	1628 (7.5%)
	Other services	6081 (28.0%)
ISCO	Legislators, senior officials and managers	1298 (6.0%)
	Professionals	3343 (15.4%)
	Technicians and associate professionals	3693 (17.0%)
	Clerks	2713 (12.5%)
	Service workers and shop and market sales workers	3831 (17.7%)
	Skilled agricultural and fishery workers	193 (0.9%)
	Craft and related trades workers	2647 (12.2%)
	Plant and machine operators and assemblers	1937 (8.9%)
	Elementary occupations	2050 (9.4%)
Vibrations	¼ of the time or less	18274 (84.2%)

	½ of the time or more	3431 (15.8%)
Tiring positions	¼ of the time or less	14673 (67.6%)
	½ of the time or more	7032 (32.4%)
Lifting people	¼ of the time or less	20375 (93.9%)
	½ of the time or more	1330 (6.1%)
Moving heavy loads	¼ of the time or less	17633 (81.2%)
	½ of the time or more	4072 (18.8%)
Repetitive movements	¼ of the time or less	9849 (45.4%)
	½ of the time or more	11856 (54.6%)
Job Strain	Low	15286 (70.4%)
	High	6419 (29.6%)
Contract	Indefinite	18152 (83.6%)
	Temporary	3553 (16.4%)
Sector	Private	13615 (62.7%)
	Public	6625 (30.5%)
	Other	1465 (6.8%)
Work at night	Times a month	1.3 (3.6)
Work at weekend	Times a month	1.6 (2.2)
Shift work	No	17140 (79.0%)
	Yes	4565 (21.0%)
Working hours	Average per week	38.7

Table 2: Odds ratios and 95% confidence intervals for the association between working conditions and self-reported health in Europe (27 countries)

			Model 1 (covariates)		Model 2 (model 1 + physical work environment)		Model 3 (model 1 + psychosocial work environment)		Model 4 (model 1 + work organization)		Model 5 (model 1+2+3+4)	
Sex	Male		1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Female		1.28	[1.18,1.38]	1.22	[1.13,1.32]	1.23	[1.14,1.33]	1.30	[1.20,1.41]	1.20	[1.11,1.31]
Age	16-29		1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]
	30-39		1.61	[1.43,1.81]	1.65	[1.46,1.86]	1.64	[1.45,1.85]	1.68	[1.48,1.89]	1.72	[1.52,1.95]
	40-49		2.67	[2.38,3.00]	2.78	[2.47,3.12]	2.74	[2.45,3.08]	2.81	[2.50,3.16]	2.93	[2.61,3.31]
	50-60		4.43	[3.94,4.97]	4.67	[4.16,5.26]	4.59	[4.08,5.16]	4.70	[4.18,5.30]	4.99	[4.42,5.63]
Education	No/primary		1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Secondary		0.62	[0.52,0.74]	0.67	[0.56,0.80]	0.63	[0.53,0.75]	0.62	[0.52,0.74]	0.67	[0.56,0.81]
	Post Secondary		0.65	[0.52,0.82]	0.73	[0.58,0.92]	0.67	[0.53,0.84]	0.65	[0.51,0.81]	0.73	[0.58,0.92]
	Tertiary		0.52	[0.42,0.63]	0.61	[0.50,0.75]	0.54	[0.44,0.66]	0.52	[0.43,0.64]	0.62	[0.51,0.76]
Nace	Agriculture		1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Industry		0.93	[0.72,1.21]	0.91	[0.70,1.18]	0.87	[0.67,1.12]	0.98	[0.75,1.26]	0.90	[0.69,1.17]
	Services		0.90	[0.70,1.17]	0.93	[0.72,1.20]	0.86	[0.66,1.11]	0.92	[0.72,1.20]	0.92	[0.70,1.19]
	Public admin		0.94	[0.72,1.24]	0.98	[0.74,1.29]	0.92	[0.70,1.21]	0.96	[0.72,1.28]	0.98	[0.73,1.31]

	Other services	0.91	[0.70,1.18]	0.91	[0.70,1.18]	0.89	[0.68,1.15]	0.91	[0.70,1.18]	0.90	[0.69,1.18]
ISCO	Legislators	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Professionals	1.07	[0.89,1.28]	1.05	[0.88,1.27]	1.02	[0.85,1.22]	1.09	[0.90,1.31]	1.03	[0.86,1.24]
	Technicians	1.15	[0.96,1.37]	1.11	[0.93,1.32]	1.08	[0.91,1.29]	1.16	[0.97,1.38]	1.07	[0.90,1.28]
	Clerks	1.26	[1.05,1.52]	1.20	[1.00,1.45]	1.16	[0.97,1.40]	1.29	[1.07,1.55]	1.16	[0.96,1.40]
	Service workers	1.42	[1.18,1.70]	1.24	[1.03,1.49]	1.32	[1.10,1.58]	1.32	[1.10,1.58]	1.16	[0.96,1.39]
	Agricultural	1.39	[0.91,2.12]	0.97	[0.63,1.49]	1.27	[0.83,1.93]	1.37	[0.90,2.09]	0.93	[0.60,1.43]
	Craft	1.93	[1.59,2.33]	1.35	[1.11,1.65]	1.70	[1.40,2.06]	1.93	[1.60,2.34]	1.30	[1.07,1.59]
	Plant	2.08	[1.71,2.51]	1.55	[1.27,1.89]	1.74	[1.43,2.11]	2.00	[1.65,2.43]	1.41	[1.15,1.72]
	Elementary occupations	2.30	[1.90,2.78]	1.70	[1.40,2.06]	2.05	[1.70,2.49]	2.24	[1.85,2.72]	1.60	[1.31,1.95]
Vibrations				1.11*	[1.01,1.23]					1.09	[0.98,1.21]
Tiring positions				1.87*	[1.72,2.02]					1.78*	[1.64,1.94]
Lifting people				1.08	[0.93,1.25]					1.06	[0.91,1.23]
Moving heavy loads				1.24*	[1.13,1.36]					1.19*	[1.08,1.30]
Repetitive movements				1.28*	[1.18,1.38]					1.22*	[1.13,1.32]
Job strain						1.72*	[1.60,1.85]			1.42*	[1.32,1.54]
								1.00	[1.00,1.00]	1.00	[1.00,1.00]

Contract	Indefinite										
	Temporary							1.26*	[1.14,1.39]	1.24*	[1.13,1.37]
Sector	Private							1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Public							1.03	[0.94,1.14]	1.02	[0.92,1.13]
	Other							1.20*	[1.04,1.37]	1.21*	[1.05,1.39]
Work hours	Average per week							1.00	[1.00,1.01]	1.00	[1.00,1.01]
Shift work	No							1.00	[1.00,1.00]	1.00	[1.00,1.00]
	Yes							1.11*	[1.01,1.21]	1.03	[0.94,1.12]
Work at night	Times per month							1.00	[0.99,1.01]	1.00	[0.99,1.01]
Work at weekend	Times per month							1.03*	[1.01,1.05]	1.01*	[1.00,1.03]

*Significant at the 5% level

Table 3: Odds ratios and 95% confidence intervals for the association between working conditions and self-reported health by European welfare state regime (adjusted for covariates, physical working conditions, psychosocial working conditions and work organization).

	Scandinavian	**Anglo-Saxon**	**Bismarckian**	**Southern Europe**	**Eastern Europe**	**Comparison by welfare state regime (p value)**
Vibrations from machinery etc.	1.25 (0.88-1.77)	1.05 (0.58-1.92)	0.97 (0.81-1.15)	1.55* (1.14-2.10)	1.12 (0.95-1.31)	0.52
Tiring or painful positions	2.09* (1.63-2.69)	2.04* (1.33-3.13)	2.09* (1.82-2.40)	1.67* (1.30-2.14)	1.70* (1.49-1.93)	0.11
Lifting or moving people	0.80 (0.53-1.22)	1.40 (0.76-2.56)	0.97 (0.77-1.21)	1.11 (0.66-1.87)	1.35* (1.02-1.79)	0.59

Carrying or moving heavy loads	1.12 (0.82-1.52)	0.99 (0.61-1.61)	1.32* (1.13-1.55)	1.50* (1.10-2.03)	1.16 (1.00-1.35)	0.25
Repetitive hand or arm movements	1.34* (1.07-1.67)	1.18 (0.81-1.72)	1.30* (1.14-1.49)	1.24 (0.96-1.60)	1.27* (1.12-1.44)	0.60
Job strain	1.67* (1.36-2.04)	1.26 (0.87-1.83)	1.89* (1.68-2.14)	1.79* (1.43-2.23)	1.58* (1.40-1.78)	0.06
Contract - Indefinite - Temporary	1.0 0.97 (0.71-1.34)	1.0 1.24 (0.80-1.90)	1.0 1.36* (1.15-1.61)	1.0 1.25 (0.96-1.63)	1.0 1.29* (1.10-1.51)	0.32
Shift work	0.98	1.01 (0.62-1.61)	1.12 (0.96-1.31)	0.88 (0.66-1.19)	1.27* (1.10-1.46)	0.57

	(0.72-1.34)					
Sector - Private - Public - Other	 1.0 1.26 (0.95-1.67) 1.20 (0.74-1.94)	 1.0 0.63 (0.37-1.07) 1.11 (0.55-2.24)	 1.0 0.96 (0.81-1.13) 1.32* (1.07-1.62)	 1.0 1.20 (0.82-1.73) 1.03 (0.56-1.89)	 1.0 1.02 (0.87-1.19) 1.05 (0.84-1.31)	0.39
Working hours	0.98 (0.97-1.00)	1.01 (0.99-1.03)	1.00 (0.99-1.01)	1.01 (1.00-1.03)	1.01 (1.00-1.02)	0.00
Work at night	1.00 (0.97-1.03)	1.00 (0.96-1.04)	1.01 (0.99-1.03)	1.03 (1.00-1.05)	0.99 (0.97-1.01)	0.40
Work at weekends	1.07* (1.01-1.13)	1.07 (0.99-1.16)	1.05* (1.02-1.08)	0.99 (0.94-1.05)	1.01 (0.98-1.04)	0.07

*Significant at the 5% level